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HIGHER EDUCATION STUDENTS' EXPERIENCE IN A DIGITAL EDUCATIONAL MODALITY

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Abstract: In 2020, universities worldwide migrated abruptly from face-to-face education to an emergency remote distance format to respond to the SARS-CoV-2 pandemic. The present study aimed to assess this type of learning experience from higher education students' perspectives. A mixed-method design was conducted with 796 students from six different disciplinary schools. The questionnaire included five constructs *(Pedagogical*, *Collaboration*, *Learning Resources*, *Time Management,* and *Functional Features)* with 17 quantitative items rated on a 1-5 Likert scale (Cronbach's Alpha = 0.955). Answers from two open questions were coded into two categories: *Positive Experiences* and *Aspects to Improve*. The highest constructs were *Functional Features* (3.60) and *Time Management* (3.15). The lowest score was *Collaboration* (2.77). Students appreciated the digital experience using Zoom and Canvas and their flexibility with time and space in their self-management. They recommended improving the interactions among peers and teachers with shorter and more interactive synchronous sessions. Even though there was only one week to prepare for the change from face-to-face to emergency remote distance learning, the students successfully continued their education. An updated distance teaching method was improved and implemented after reviewing the results of the present study. Since August 2020, more than 50 thousand higher education students have been taught via this enhanced digital educational modality.

Keywords: educational innovation, higher Education, digital education, flexible education, Zoom, canvas, SARS-CoV-2

Introduction

The SARS-CoV-2 pandemic ravages the world (Reimers & Schleicher, 2020). According to UNESCO (2020), the nationwide mandatory quarantine has impacted over 91% of the students worldwide, which means that many students' educational needs have changed and need to be addressed differently. The pandemic forced universities to reformulate education to be adaptive, coherent, effective, and equitable (Reimers & Schleicher, 2020).

Several authors (Bandaranaike *et al.*, 2020; Bergdahl & Nouri, 2020; Kamal *et al.*, 2020; Radha *et al.*, 2020; Reimers & Schleicher, 2020; UNESCO, 2020; Zhu & Liu, 2020) have mentioned specific factors that must be considered in education during the SARS outbreak: Pedagogy, Collaboration, Learning Resources, Time Management, and Functional Features.

The SARS-CoV-2 implies there must be changes related to pedagogical factors, beginning with the online experience. Previous authors (Bandaranaike *et al.*, 2020; Bergdahl & Nouri, 2020) explained

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that pedagogical strategies changed during the pandemic. Teachers must design student-centered didactic strategies, build social networks, motivate the students to engage, and guide them to learn new skills.

One of the main concerns in schools brought about by the pandemic is how to improve collaboration among students and teachers. Bergdahl and Nouri (2020) mentioned that collaboration is vital to consider when transforming the educational process during a pandemic. It facilitates the students' schoolwork and enables collective student-teacher interactions through various digital technologies to achieve educational goals.

Some features need to be considered regarding learning resources during a pandemic when education is transmitted online. They include proper instructional design to avoid students faltering in learning, developing their digital literacy, increasing discussions and collaboration among the students, motivating them, and providing appropriate feedback quickly.

Time management during the learning process has become crucial in the pandemic. According to Radha *et al.* (2020), the online method appears to suit most students because it enables them to access updated content when needed and choose their time for learning when it is convenient and comfortable.

Zhu and Liu (2020) have recommended strategies that take advantage of functional features during social distancing. These include using Zoom and other communication platforms, conducting online training to use learning resources, assembling a professional team to provide technical support, and ensuring that the students can participate in digital learning.

Bergdahl, N. and Nouri, J. (2020) have highlighted the need to be prepared and have backup plans during times of crisis, like a pandemic, to sustain schooling. So, it is relevant to study more about how a digital educational modality eases the transition to totally online education in an emergency that presents stark changes from the previous learning model. In the light of these considerations, our research team decided to build an instrument that allows higher education institutions to deal with educational issues that arise in unfamiliar contexts and unforeseen circumstances.

Olivares *et al.* (2021) proposed to analyze six quality dimensions for Massive Online Open Courses (MOOCs). Their model was adapted and designed to assess the students' perception of the distance learning modality implemented due to SARS-CoV-2. This study aimed to evaluate the students' perceptions of this digital educational modality implemented by the university to ensure higher education quality during the pandemic.

Considering the previous studies mentioned, we designed a model with five quality dimensions. The studied constructs were pedagogy, collaboration, learning resources, time management, and functional features. Unlike the learning model assessment for MOOCs, the design aesthetics dimension was not included in the pandemic context analysis. In this research, the pedagogy dimension refers to the pedagogical approach, content, learning outcomes, and evaluation. The collaboration dimension considers aspects related to interactions and information flow. The learning resources dimension includes educational platforms, content presentations, and digital resources. The time management dimension refers to agenda and activity timing, and functional features considers how technological resources and educational platform functions facilitated learning and communication (Figure 1).

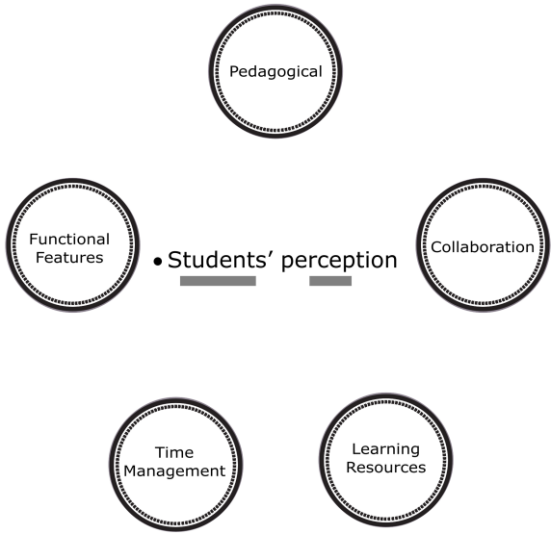

Figure 1: The proposed model to assess higher education students' perception.

Literature review

A flexible and digital educational model

According to Tecnologico de Monterrey (2020), a flexible and digital educational model is:

"A learning model that integrates innovative teaching strategies and cutting-edge technologies. The model proposes the design of a flexible and digital learning experience that combines the following academic components: Content, interaction, learning activities, technological tools, and evaluation." (Tecnologico de Monterrey, 2020, para 3)

Some of the digital modality features are flexibility, accompaniment, feedback from professors, interactive tools, availability of learning resources, active learning, and use of educational technology (Tecnologico de Monterrey, 2020).

Pedagogical dimension

Aini *et al.* (2020) reported how digital learning plays an essential role during a pandemic; however, it also challenges higher education institutions, students, and lecturers; therefore, the pedagogical dimension becomes essential for the well-functioning of the teaching and learning process.

The pedagogical dimension of an e-learning modality implemented during a pandemic seeks to facilitate learning outcomes and assessment. Online learning platforms like Zoom allow educators and students to connect in real-time using video conferencing to improve communication (Rhada *et al.*, 2020).

Collaboration dimension

Elzainy *et al.* (2020) explained that during the SARS-CoV-2 pandemic, it is essential to facilitate collaborative interaction in the online environment to optimize information flow and enhance peer sharing.

Learning Resources dimension

Almaiah *et al.* (2020) reported how important it is that universities focus on instilling the culture of e-learning systems among students by training them to use educational platforms and digital resources effectively. This promotes the successful adoption of e-learning systems.

Time Management dimension

Rhada *et al.* (2020) declared that e-Learning during the SARS-CoV-2 confinement has made education available to many learners, with the advantage of choosing to learn at a convenient time, enabling them to access updated content whenever they want.

Functional features

Rannastu-Avalos and Siiman (2020) mentioned that virtual learning is a challenge for students because they may deal not only with technological issues but also cognitive and social ones. So, the appropriate functional features of e-learning systems help to address those issues.

Justification

Minghat *et al.* (2020) have pointed out the need to investigate students' perceptions of the online learning processes during the SARS-CoV-2 outbreak. This kind of investigation may provide inputs helpful in establishing educational strategies to improve the online experience.

It is vital to meet students' educational needs in times of crisis, such as SARS-CoV-2 (Şeker, 2020). Analyzing the students' experience in e-learning may help guide higher education institutions to fulfill the students' needs and prioritize the policies and strategies to implement remote learning effectively during a pandemic (Aini *et al.*, 2020).

The instrument could offer higher education institutions an opportunity to focus on attending to the students' needs and defining roles and duties (Buzgan & Güner, 2020). Studying the e-learning experience can lead universities to have a successful e-learning system (Almaiah *et al.*, 2020). These kinds of studies eventually yield information for analyses that improve future education.

Method

A mixed-method design was conducted with students from six different disciplinary schools: School of Science and Engineering; School of Business; School of Architecture, Art and Design; School of Social Sciences; School of Humanities and Education; and School of Medicine and Health Sciences. For the quantitative analysis, a questionnaire was designed to evaluate students' perspectives about the distance modality implemented due to social distancing contingencies. The five constructs considered in the research instrument were pedagogy, collaboration, learning resources, time management, and functional features. A reliability test was conducted, yielding the estimated Cronbach's Alpha of 0.955. The instrument had 17 items rated on a 1-5 Likert scale.

For the qualitative analysis, two open questions were added at the end of the instrument: Mention positive learning experiences, and in your opinion, what aspects do you consider can be improved? The responses were classified into two categories: Positive Experiences and Aspects to Improve.

All higher education students enrolled in at least one course were invited to answer the survey at Qualtrics. The survey was available from May 18 to 25, 2020. Due to low participation, a second invitation was sent, motivating students to answer. It offered new available dates: June 4-10, 2020. In total, 796 students participated in the sample. Their ages were between 17 and 19 years old. Table 1 displays their composition by School.

Table 1: Sample composition by School

	Students	Percentage
School of Science and Engineering	349	43.85%
School of Business	219	27.51%
School of Architecture, Art and Design	25	3.14%
School of Social Sciences	54	6.78%
School of Humanities and Education	128	16.08%
School of Medicine and Health Sciences	21	2.64%

This study was conducted using the ethics protocol suggested by Dooly *et al.* (2017): The study does not cause potential harm to anyone involved, provides sufficient information to participants to comprehend the research project's scope fully, ensures the confidentiality of all research subjects, and the data was used for educational purposes. So, learners were free to participate in the study. Those who did were informed that their data would be safeguarded and anonymized for finding results. They were also informed that their participation would improve the university's quick response to ensure high-quality education.

Results

The quantitative and qualitative results of the samples studied are presented in this section. The quantitative research instrument is presented as part of the findings.

Quantitative findings

As Olivares *et al.* (2021) state, academic content is a priority of online courses; when easy-to-use technology is also part of the solution, the students' experiences are expected to be positive. This was the hypothesis of the university's design of the digital educational modality implemented in April 2020; its more than 30 years of experience in offering distance education was a key advantage when migrating all the undergraduate programs to the digital modality.

Table 2 shows the 17 items considered in the designed instrument each item classified into a quality dimension.

Table 2: Quality dimensions when assessing students' perceptions of the digital educational modality

Quality dimension	Item
Pedagogical	
	The scheduled activities and the teachers' assistance helped me to achieve the learning goals, despite the distance.
	The feedback I receive under the digital modality helped me improve my performance.
	Participation in all class sessions through Zoom / Microsoft Teams added value to my learning.
Collaboration	
	The digital modality allowed me to be active in my classes, providing comments, asking questions, and collaborating with my classmates.
	The different interaction options established through the digital modality facilitated the teaching-learning process.
	Classes under the digital modality developed naturally, like a face-to-face class, in terms of schedules and interaction.
Learning Resources	
	The use of different technological applications during my classes helped me to understand the contents better.
	The contents provided by teachers during the sessions under the digital modality facilitated my learning.
	The digital modality has made it possible to expand how I am evaluated and the diversity of learning evidence.
	Class activities were dynamic because they included innovative elements that captured my interest and motivated me.
Time Management	
	The digital modality allowed me to do my learning activities in different places and times.
	With the digital modality implementation, I produced the training units' deliverables in a more autonomous, efficient, and self-managed way.
	The digital modality allowed me to learn through various times, spaces, activities, and contexts.

	I have noticed that the digital modality allowed flexible activities to be included in my classes.
Functional Features	
	The Zoom tool's interface was user-friendly, allowing me to participate without a problem during my sessions.
	I believe that the Canvas platform facilitated the teaching and learning process.
	The technological tools used in the digital modality facilitated my communication with classmates.

The Likert scale ranged from 1 to 5, where 5 was the maximum rating for students' perception. The estimated mean for each item was below 4. The item with the highest mean was, The Zoom tool's interface was user-friendly, allowing me to participate without a problem during my sessions (3.94). The lowest one was, Class activities were dynamic because they included innovative elements that captured my interest and motivated me (2.52).

The results for the Quality dimensions means, estimated for each category and organized in ascending order, were: Collaboration 2.77, Learning Resources 2.96, Pedagogical 3.09, Time Management 3.14 and Functional Features 3.60 (see Figure 2). These findings reveal that students' perception of collaboration during the pandemic is an improvement opportunity for the institution.

The results also highlight that the experienced digital education team selected two robust educational platforms for the digital modality: Canvas and Zoom, both evaluated positively in the Functional Features category.

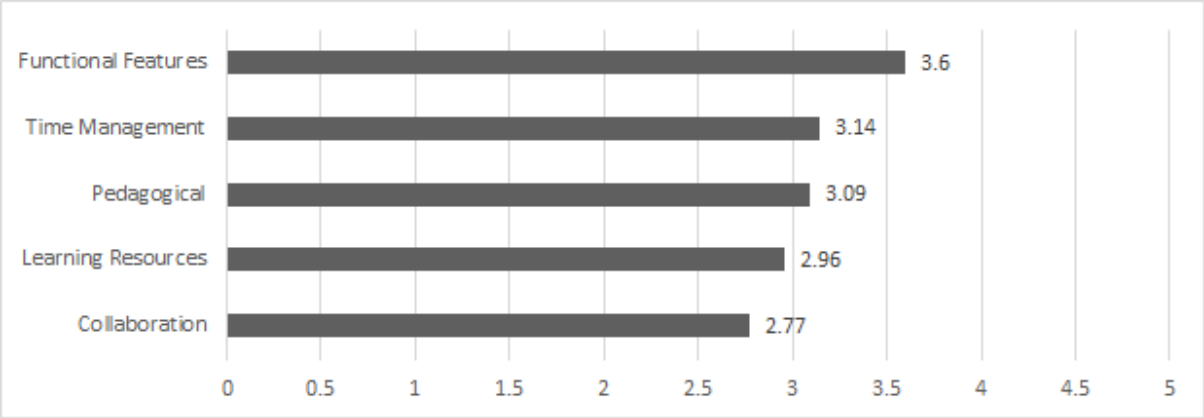

Figure 2: The quality dimensions' means for the digital educational modality.

Qualitative findings

The qualitative analysis complemented the numeric results of the quantitative perspective. As mentioned before, two open questions were included at the end of the instrument. The first one asked about positive aspects of the learning experience and the second one for improving. The five-

dimensions model also guided the categorization of both open questions. Table 3 summarizes the most common mentions.

Table 3: The most mentioned Positive Experiences and Aspects to Improve

Positive Experiences	
Pedagogical	The effort to continue teaching. Class adaptation to an attractive digital modality. Teacher dedication, patience, disposition, and motivation of the students.
Collaboration	Communication with professors and colleagues. Speed in resolving questions.
Learning Resources	The recording of the sessions allowed students to review the contents several times.
Functional Features	The Zoom tool made the learning process easier.
Time Management	Flexible class schedule. View class from anywhere. Ease of movement. The flexibility of consults with teachers.
Aspects to Improve	
Pedagogical	Design of interactive, simple, innovative, practical, dynamic, participatory, and flexible activities adapted to a digital modality and updated in Canvas. Less extensive content adapted to the model, more depth in the topics, and a reduced agenda.
Collaboration	Prompt and personalized feedback.
Learning Resources	Laboratories activities in a face-to-face format.
Functional Features	Teacher training in technology (Canvas and Zoom), pedagogy (didactics), and adapting classes to the model.
Time Management	Reduce the duration of classes. Avoid spending too much time in front of the computer. Include breaks during and between classes.

The qualitative results reinforced what the quantitative analysis revealed. Students recognized the effort made by the University and its professors to ensure the continuity of teaching during the social distancing regulations caused by the pandemic. They also identified that the Zoom platform made learning easier; they benefitted from access to the recorded classes, which helped them review what had been studied in the synchronous sessions.

The responses to the open question, in your opinion, what aspects do you consider can be improved? were of great relevance to the institution. These comments from the first quick digital solution implemented are input to construct a more robust solution for the more than fifty thousand undergraduate students nationwide on the University's campuses. During summer 2020, the six national Schools mentioned previously improved the online modality adaption, developing more attractive and innovative learning resources. A significant effort was made to train teachers; a set of courses was declared as basic training for them, and only those who received the training were programmed for the August-December 2020 semester. Last but not least, time management was

crucial during the pandemic. Professors were invited to use time efficiently in the Zoom sessions, remembering that assigning homework means students spend additional time in front of their monitors. They were advised to include a short break during their sessions.

Discussion and Conclusions

The instrument's design made it possible to collect pertinent information related to the five dimensions previously mentioned in the context of the digital educational modality used in a pandemic. The instrument's data contributed to broadening the vision of the experience that students had under this modality and understanding what they valued most about it.

Research results indicated that students had a favorable perception of the digital modality and the institution's response capacity in the face of the SARS-CoV-2 contingency. The Business School students declared the most favorable perception of the digital modality.

In general, students appreciated Zoom's friendly interface, the Canvas platform's ease of use, and the digital modality's flexibility to study from anywhere and anytime.

The students felt that the digital modality needed to improve the Zoom sessions' duration, the interactions with peers and the teacher, and offer more interactive, dynamic and innovative learning activities.

Although the University had just one week to prepare for the change from a face-to-face educational modality to remote distance learning due to the SARS-CoV-2 lockdown, it succeeded. The students continued their education. From this study's results, it was possible to update and improve a digital education modality beginning in August 2020 to the present for more than fifty thousand higher education students.

The results from this study provided helpful information about the students' learning process and their educational expectations during the pandemic. Some of the recommendations for the five quality dimensions follow.

Pedagogical dimension

According to the results shown in Table 2, it might be useful to consider the Elzainy *et al.* (2020) recommendations regarding the e-learning experience during the SARS-CoV-2 pandemic. These include offering sustained monitoring, technical personnel to support faculty and students, updating the e-learning resources, having training programs for improving faculty development, and motivating the students to take on self-directed learning. It is also recommended to use assessment methods so that students can complete the test in a flexible time frame (Özer & Suna, 2020)

Collaboration dimension

This study's findings are similar to Rannastu-Avalos and Siiman (2020), noting that it is a challenge for distance learning to facilitate collaborative learning. To elevate collaboration and teamwork in a digital educational modality, educators must design it to be a secure online learning environment that fosters a sense of community among the learners, as Karalis and Raikou (2020) mentioned.

Learning Resources dimension

This study's findings make evident how crucial the learning resources are for ensuring a good learning experience. Rephrasing the suggestion of Almaiah *et al.* (2020) previously, universities must focus on instilling the culture of e-learning systems among students by training them to use educational platforms and digital resources effectively because it leads to the successful adoption of e-learning systems.

Time Management dimension

To improve time management, one must consider previous authors' suggestion (Almaiah *et al.*, 2020; Rhada *et al.*, 2020) that universities need to ensure that all students and instructors are fully self-efficacious and have the skills to use the system and time wisely.

Functional features dimension

To build on the results shown in Table 2, educators should consider some suggestions related to functional features from previous authors such as (Aboagye, *et al.*, 2020). These relate to accessibility, the usability of the e-learning system, the expansion of technical support, and verification that the system supports devices or equipment used by students and teachers.

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